

EOSDIS Core System Project

**Interface Control Document
Between the EOSDIS Core System
(ECS) and the Stratospheric
Aerosol and Gas Experiment III
(SAGE III) Mission Operations
Center (MOC)**

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National Aeronautics and
Space Administration

Goddard Space Flight Center
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**Interface Control Document Between the EOSDIS
Core System (ECS) and the Stratospheric Aerosol and Gas
Experiment (SAGE III) Mission Operations Center (MOC)**

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Preface

This document is a contract deliverable with an approval code 1. Once approved, contractor changes to this document are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This Interface Control Document (ICD) defines the preliminary functional and physical design of system interfaces between the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) and the SAGE III Project's Mission Operations Center (MOC).

This ICD presents the interface definitions between the ECS Release B and the SAGE III MOC. These interfaces include the SAGE III Level 0 data products and definitive orbit data products and the associated data transfer messages. |CH02

This interface does not define the SAGE III Science Computing Facility (SCF) to ECS at the LaRC DAAC interfaces. Those interfaces are defined generically in the "ICD Between the ECS and the Science Computing Facility" (referenced document in Section 2).

This ICD is consistent with the Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS Level 3 requirements) and the Interface Requirement Document (IRD) Between the ECS and the SAGE III Mission Operations Center (MOC).

Keywords: active, ancillary, archive, campus, center, communications, control, DAAC, Product Delivery Record, Product Deliver Record Discrepancy, Production Acceptance Notification, flows, FTP, LaRC, Mission Operations Center, MOC, ODL, PVL, SAGE

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Abbreviations and Acronyms

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1. Introduction

1.1 Identification

This Interface Control Document (ICD), Contract Data Requirements List (CDRL) Item 029 whose requirements are specified in Data Item Description (DID) 209/SE1, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000).

1.2 Scope

ECS Releases are keyed to mission support: Release Ir1 provides support to the Tropical Rainfall Measuring Mission (TRMM) Early Interface Testing and Science Algorithm I&T. Release A provides support to TRMM Science Operations and TRMM Ground Systems Certification Testing. Release A also provides the functional capabilities needed to support early Science Software Integration and Test for the EOS AM-1, Landsat 7 and SAGE III missions. Release B provides EOS AM-1 mission (flight) operations and science operations. Release B provides Landsat 7 and the SAGE III science operational support. This includes user services, planning, processing, archiving and distribution services. Releases C & D provide evolutionary enhancements to the ECS services provided in the earlier Releases.

The ICD provides preliminary definition for the system interfaces between the ECS at the LaRC DAAC and the SAGE III MOC. This ICD **does not** define the interface between the SAGE III SCF and the ECS at the LaRC DAAC. The ECS-SCF interface documents are referenced in Section 2.

For the ECS Release B to SAGE III MOC interface, this ICD provides definition of the data exchange framework, definition of the data exchange protocol for transferring low volume data files from the SAGE III MOC to the ECS, the SAGE III MOC-ECS physical communications connection and the metadata, Level 0, definitive orbit and ancillary data definition. This document reflects the technical baseline maintained by the ECS Configuration Control Board in accordance with ECS technical direction (see Section 2.2). CH02

In its final version the Earth Science Data and Information System (ESDIS) Project has responsibility for the development and maintenance of this ICD with support from SAGE III Project. Any changes in the interface definition will be agreed to by the relevant participating parties, and then assessed at the ESDIS Project Level. The final version of this ICD is approved under the signatures of the ESDIS and SAGE III Project Managers.

1.3 Purpose and Objectives

This document is written to formalize the interpretation and general understanding of the interfaces between ECS and the SAGE III MOC. This document provides clarification and elaboration of the ECS/SAGE III MOC interface specification to the extent necessary to assure hardware, software, and operational service compatibility within the end-to-end system.

This document provides a point of mutual control of external interface definitions via the ESDIS Configuration Control Board (CCB).

1.4 Status and Schedule

This ICD between the ECS and SAGE III MOC which will be implemented in ECS Release B. This ICD is submitted as an ECS Project CCB approval Code 1 document.

Within this document are some interfaces that have yet To Be Determined (TBD), and/or To Be Supplied (TBS) items. A Work-Off Plan is submitted as part of Appendix A within this document. This plan will provide the following information:

- a. ICD I/F Issue Number
- b. ICD Reference Paragraph
- c. ICD Issue Priority
- d. ICD Issue Type - Description
- e. Work-off Plan Task(s)
- f. Projected Resolution Date
- g. Risk Assessment

In its final form, at the Government's option, this document may be designated to be under full Government CCB control. Changes may be submitted at any time for consideration by Contractor and Government CCBs under the normal change process.

1.5 Organization

Section 1 provides information regarding the identification, scope, purpose and objectives, and organization of this document.

Section 2 provides a listing of the related documents which were used as a source of information for this document.

Section 3 provides an overview of the Meteor-3M/SAGE III Ground System Configuration (U.S. elements) which includes the ECS and the SAGE III MOC. Also included are the ECS-SAGE III MOC interfaces and data and message transfer mechanism overview.

Section 4 includes a detailed discussion of the data exchange framework. Specifically, the following topics are discussed: applicable internetworking protocols, network topology, polling with delivery record and associated messages, data transfer (including error conditions, error handling, backup methods, and physical media), and data exchange security.

Section 5 addresses the data flows between ECS and the SAGE III MOC. The specific data products exchanged are identified including product name, file name, frequency, file size, volume and format.

A list of abbreviations and acronyms is also provided.

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2. Related Documents

2.1 Parent Documents

The following are parent documents from which this document's scope and content derive:

193-208-SE1-001	Methodology for Definition of External Interfaces for the ECS Project
219-CD-027-002	Interface Requirements Document Between EOSDIS Core System (ECS) and the Stratospheric Aerosol and Gas Experiment (SAGE III) Project
301-CD-002-003	System Implementation Plan for the ECS Project
423-10-01-5	Goddard Space Flight Center, Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 5: EOSDIS Version 0; through CH-01, 9/13/93
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work, through CN-14, 4/25/95
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) Revision A through CH-06, 4/25/95
505-10-20	Goddard Space Flight Center, System Interface Control Plan for the Earth Science Data and Information System (ESDIS) Project
475-00-01	Langley Research Center, SAGE III Agreement Between GSFC/Mission to Planet Earth Office and LaRC/SAGE III Principal Investigator LaRC/SAGE III Project Office (Draft)

2.2 Applicable Documents

The following documents are referenced herein and are directly applicable to this document. In the event of conflict between any of these documents and this ICD, this document shall take precedence. Please note that Internet links cannot be guaranteed for accuracy or currency.

305-CD-008-001	Release A SDPS Data Server Subsystem Design Specification for the ECS Project
305-CD-009-001	Release A SDPS Ingest Subsystem Design Specification for the ECS Project
305-CD-012-001	Release A CSMS Segment Communications Subsystem Design Specification for the ECS Project

305-CD-024-002	Release B SDPS Data Server Subsystem Design Specification for the ECS Project
305-CD-025-002	Release B SDPS Ingest Subsystem Design Specification for the ECS Project
305-CD-028-002	Release B CSMS Communication Subsystem Design Specification for the ECS Project
311-CD-008-001	Release B Science Data Processing Segment (SDPS) Database Design and Database Schema Specifications for the ECS Project
175-WP-001-001	HDF-EOS Primer for Version 1 EOSDIS (White Paper for the ECS Project)
210-TP-001-006	Technical Baseline for the ECS Project, 2/14/96
TD No. 11	Goddard Space Flight Center, ECS Technical Direction No. 11, "PDR Technical Baseline," 12/6/94
510-ICD-EDOS/EGS	Goddard Space Flight Center, Earth Observing System (EOS) Data And Operations System (EDOS) Interface Control Document Between The Earth Observing System (EOS) data and Operations System (EDOS) and the EOS Ground System (EGS) elements, 8/96, Final
475-01-021	Langley Research Center, Meteor-3M / SAGE III Level 0 / Definitive Orbit Data Format Description
CCSDS 641.0-B-1	Consultative Committee for Space Data Systems (CCSDS), Parameter Value Language Specification, Blue Book
RFC 791	J. Postel: Internet Protocol, 9/81
RFC 793	J. Postel: Transmission Control Protocol, 9/81
RFC 1510	C. Neuman: The Kerberos Network Authentication Service, 9/93
none	Davis, Randy; University of Colorado Laboratory for Atmospheric and Space Physics: User's Guide for the Object Description Language (ODL) Processing Software Library, Release 2.1 DRAFT, 3/13/91
none	Planetary Data System Standards Reference, Version 3.1, 8/94 (WWW access: http://stardust.jpl.nasa.gov/stdref/stdref.html)

2.3 Information Documents

The following documents, although not directly applicable, amplify or clarify the information presented in this document, but are not binding.

194-201-SE1-001	Systems Engineering Plan for the ECS Project
193-202-SE1-001	Standards and Procedures for the ECS Project
333-CD-003-004	Appendix J of Release A SCF Toolkit Users Guide for the ECS Project
604-CD-002-003	Operations Concept for the ECS Project: Part 2B -- ECS Release B
505-41-12	Goddard Space Flight Center, IRD between ECS and Science Computing Facilities, 5/95
505-41-33	Goddard Space Flight Center, Interface Control Document Between EOSDIS Core System (ECS) and Science Computing Facilities (SCF), 1/96

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3. Interface Overview

This section provides an overview of the Meteor-3M/SAGE III Ground System Configuration (U.S. elements) which includes the ECS and the SAGE III MOC. Also included are the ECS-SAGE III MOC interfaces and data and message transfer mechanism overview.

3.1 ECS - SAGE III MOC Relationship Overview

The ECS at the LaRC DAAC and the SAGE III MOC at LaRC work together to provide SAGE III science data products for science community research. Figure 3-1 illustrates the Meteor-3M/SAGE III Ground System Configuration (U.S. elements) which includes the ECS and SAGE III MOC interface. The Wallops Flight Facility (WFF) is the U.S. tracking station that acquires telemetry and science data from the SAGE III instrument onboard the Russian Space Agency's Meteor-3M spacecraft (August 1998 launch date). The WFF is responsible for data reception, archival of raw data for at least two weeks and data quality monitoring. It also supports the raw signal data analysis with quality information transfer to SAGE III Mission Operations Center (MOC) at LaRC. The SAGE III MOC provides Level 0 data processing and definitive orbit services along with associated metadata generation. These products are made available to ECS via a "Polling with Delivery Record" data transfer mechanism which is described in further detail in Section 4. The ECS Science Data Processing System (SDPS) provides a set of ingest, processing, and distribution and archive services for the EOSDIS. The ECS generates SAGE III Level 1B and higher level products for the science community.

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The interface between the ECS at the LaRC DAAC and the LaRC SAGE III SCF is defined generically in the "ICD Between the ECS and the Science Computing Facility" (referenced document in Section 2).

3.2 ECS-SAGE III MOC System Interfaces

System interfaces between the ECS and the SAGE III MOC provide the means for transferring SAGE III data and for sending messages supporting data transfer. Table 3-1 provides an overview of the data and messages transferred between the ECS and the SAGE III MOC.

The interfaces listed in Table 3-1 are described within Sections 4 and 5 of this ICD to support ECS and SAGE III MOC design and test activities.

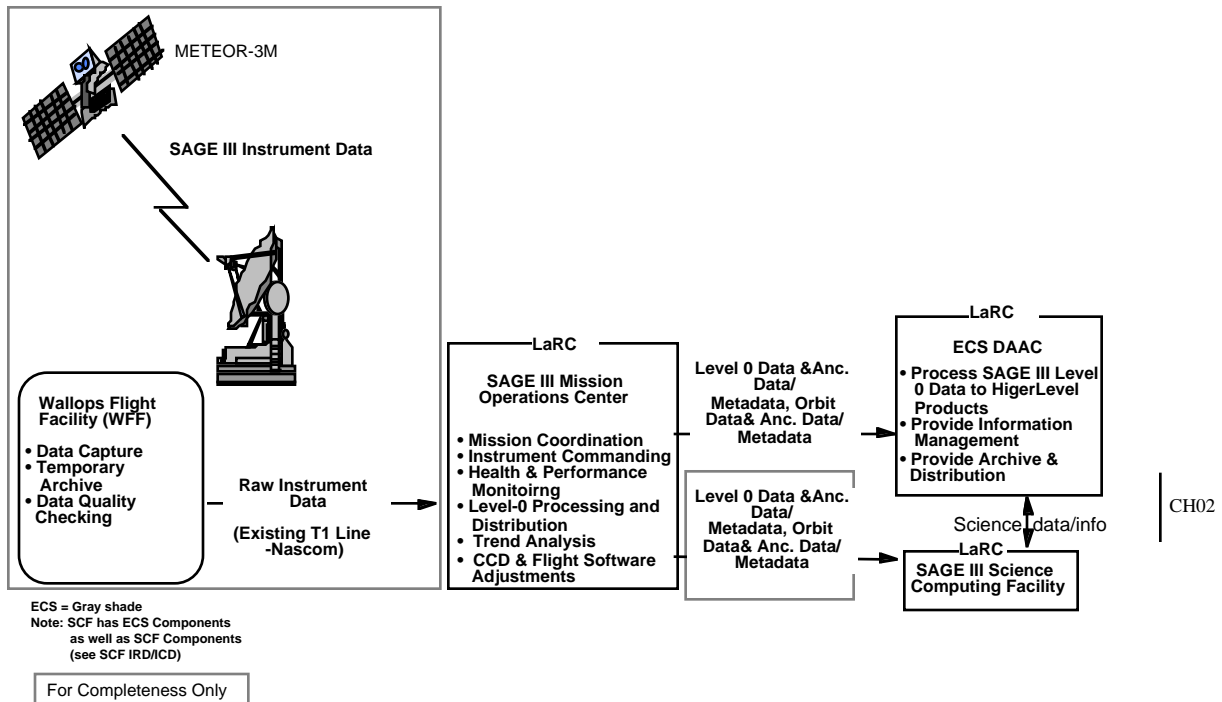


Figure 3-1. Meteor-3M/SAGE III Ground System Configuration Overview

Table 3-1. ECS and SAGE III MOC Interface Overview

Item No.	Source	Destination	Message	Data	Transfer Mechanism
1	SAGE III MOC	ECS (via SAGE III server)	*Product Delivery Records (PDR)	N/A	FTP (get)
2	SAGE III MOC	ECS (via SAGE III server)	N/A	Level 0 Data with Metadata	FTP (get)
3	SAGE III MOC	ECS (via SAGE III server)	N/A	Level 0 Ancillary with Metadata	FTP (get)
4	SAGE III MOC	ECS (via SAGE III server)	NA/	Definitive Orbit Data with Metadata	FTP (get)
5	SAGE III MOC	ECS (via SAGE III server)	N/A	Definitive Orbit Ancillary Data with Metadata	FTP (get)
6	ECS	SAGE III MOC	**Product Delivery Record Discrepancy (PDRD) (Short/Long)	N/A	FTP (push)
7	ECS	SAGE III MOC	Production Acceptance Notification (PAN) (Short/Long)	N/A	FTP (push)

* Two types of PDRs are planned - PDR 1 will define Level 0 and associated data files, PDR 2 will define def. orbit and associated data files as defined in Section 5. CH02

**This FTP message is used only in the event of an error in the Product Delivery Record

4. Data Exchange Framework

This section describes the data exchange framework supporting the ECS and SAGE III MOC system interfaces presented in Section 3.1. The descriptions include network topologies, internetworking protocols, electronic data exchange, data exchange control messages, physical media data exchange, data exchange formats and data exchange security. Specific characteristics of each ECS and SAGE III MOC data flow supported by the framework are provided in Section 5.

4.1 Internetworking Protocols (OSI Model Layers)

The ECS and SAGE III MOC communications are supported by internetworking services that are consistent with the Open Systems Interconnection (OSI) reference model, as defined in the International Organization for Standardization, Basic Reference Model of Systems Interconnection (ISO 7498). These services are also described in "Internet Programming; Jamsa Press, Nevada, 1995".

4.1.1 Physical/Datalink (Link Layer)

The ECS Release B physical network interface between ECS and SAGE III MOC at LaRC will occur via the LaRC FDDI Isolation LAN and the campus FDDI Backbone. The LaRC DAAC will connect to the FDDI Isolation LAN via the ECS Router. The building in which the SAGE III MOC hosts are located connects to the Campus FDDI Backbone via a FDDI/Ethernet Bridge. The Campus FDDI Backbone is connected to the FDDI Isolation LAN via a router.

The topology is depicted in Figure 4-1.

4.1.2 Internet Protocol (Network Layer)

The network layer provides the functional and procedural means to exchange network data units (i.e., packets) between devices over network connections, both for connection-mode and connectionless-mode communications. It relieves the transport layer of any concern regarding routing and relay operations associated with network connection. The basic function of the network layer is to provide the transparent transfer of data between devices. It should be noted that the network layer delivers packets only to a device, not an individual process---it remains up to the transport layer protocol to include, beforehand, the additional information needed to permit addressing to an individual process. Network layer protocols supported by ECS networks include Internet Protocol (IP) plus various routing protocols.

The Internet Protocol (IP), specified in RFC 791, supports network layer data exchanges between the ECS and the SAGE III MOC. The network layer provides the transparent transfer of data between transport entities. The IP addresses for the network nodes and data hosts are determined by the time of installation at LaRC.

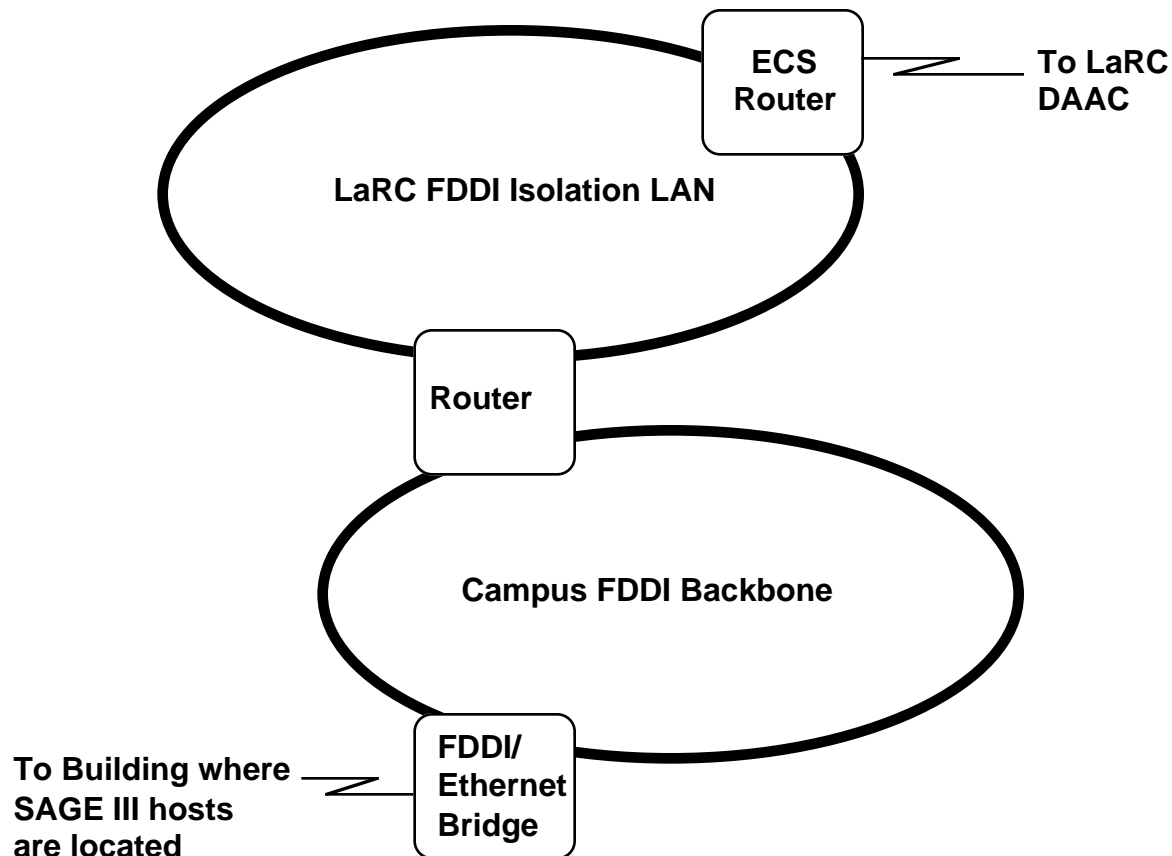


Figure 4-1. Network Interfaces Between ECS at the LaRC DAAC and the SAGE III MOC at LaRC

As part of IP support, Internet Control Message Protocol (ICMP) and Address Resolution Protocol (ARP) are also supported. As the Internet Engineering Task Force (IETF)-specified new generation IP becomes available for deployment, it will be supported by ECS networks.

ECS generally uses Routing Information Protocol (RIP) for route exchanges with external networks. Other more robust routing protocols such as Border Gateway Protocol (BGP-4) can also be used depending on the need and center routing policies.

4.1.3 Transport Protocol (Transport Layer)

Connection-oriented transport service is implemented using Transport Control Protocol (TCP). TCP, specified in RFC 793, is a connection-oriented, end-to-end reliable protocol designed to fit into a layered hierarchy of protocols which support multi-network applications. It provides for guaranteed delivery of data between pairs of processors in host computers attached to networks within and outside ECS.

4.1.4 Application Protocols (Application Layer)

The application-level protocols for data transfer between ECS and SAGE III MOC host computers are accomplished through the use of the File Transfer Protocol (FTP). The FTP protocol, described in RFC 959, is an internet standard for file transfers that supports retrieval of files from a remote server.

4.2 Polling with Product Delivery Record and Associated FTP Messages

Data exchange between the SAGE III MOC and the ECS consists of Level 0 data, definitive orbit data, ancillary (Level 0 and definitive orbit) and associated metadata sent from the SAGE III MOC to the ECS. These data are described in Section 5. Data transfer is accomplished through the use of Polling with Product Delivery Record as defined in the Release B SDPS Ingest Subsystem (INS) Design Specification for the ECS Project. Using this polling mechanism the ECS performs a "get" to retrieve the data from an SAGE III MOC file server or workstation. This section addresses the "polling with Product delivery record" data transfer mechanism, error conditions, error handling/backup methods, and physical media.

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4.2.1 Data and Message Transfer

A "Polling With Product Delivery Record (PDR)" transfer mechanism is used by the ECS Ingest Subsystem to acquire data from the SAGE III MOC. The ECS side of the interface is equipped with an FTP daemon---a computer application which invokes this data transfer mechanism as follows:

- a. Automatically, and with operator-tunable periodicity, ECS polls the SAGE III MOC server
- b. Using ftp-ls (list of files) command ECS detects a predefined unique PDR filename in the SAGE III MOC directory
- c. Acquires the Product Delivery Record file information via an FTP "get" command---i.e., initiates single file transfer from a remote server to a local host/workstation.

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The data transfer mechanism is depicted in Figure 4-2. Once a PDR has been detected/acquired by ECS, the PDR is validated. In the event that the PDR is invalid, ECS automatically returns a Product Delivery Record Discrepancy (PDRD) via FTP to the SAGE III MOC. If the PDR is valid, ECS schedules to pull the data using either a "get"; in this case no PDRD is sent. During the ingest/archive process the ECS automatically returns an "Production Acceptance Notification (PAN)" to indicate a successful or unsuccessful data ingest/archive via FTP to the SAGE III MOC. The file naming conventions and definitions of the PDR, PDRD and the PAN file are described in the following paragraphs.

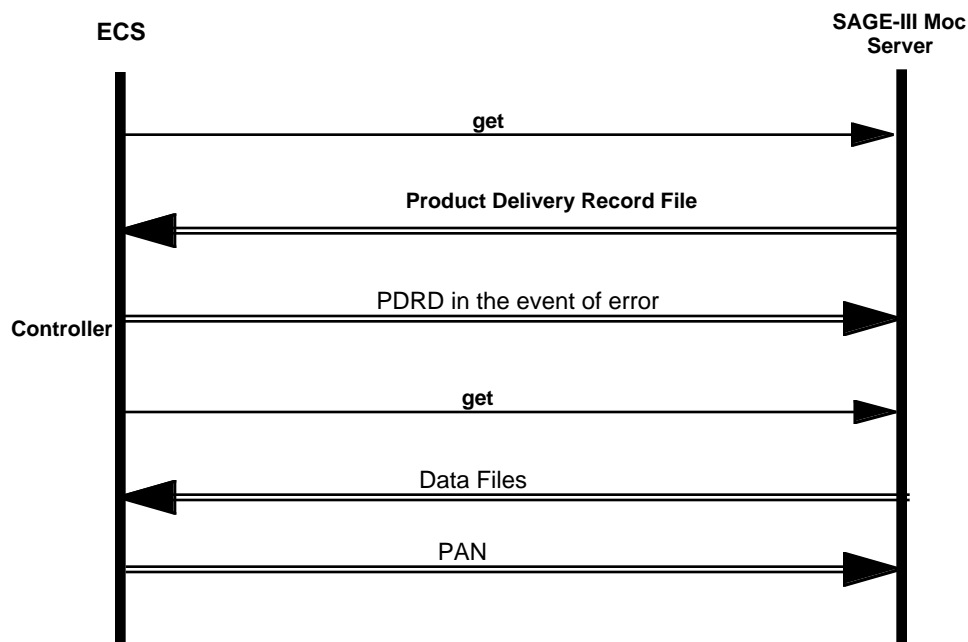


Figure 4-2. Polling With Product Delivery Record and Data Transfer at SAGE III MOC

4.2.2 Message File Naming Conventions

The following are the definitions for the file name parameters:

- a. sage3m3 is SAGE III Meteor3M Mission.
- b. lzd is Level 0 data. epd is definitive orbit (ephem) data.
- c. yyyy identifies the year.
- d. ddd identifies the day of the year.
- e. hh identifies the Hours of the day when the Delivery record was created.
- f. mm identifies the Minutes of the day when the Delivery record was created.
- g. vx.xx identifies the version number.
- h. cxx identifies the Cycle Number.
- i. type is "test" or "prod" of data.

The extension, i.e., .pdr, .pdrd and .pan uniquely defines the type of message.

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The following file naming conventions are used for the transfer of the following messages:

a. Product Delivery Record

Level 0 PDR	sage3m3_lzd_yyyymmddd_hh_mm_vx.xx_cxx_type.pdr
Definitive Orbit (Ephem) PDR	sage3m3_epd_yyyymmddd_hh_mm_vx.xx_cxx_type.pdr

b. Product Delivery Record Discrepancy

Level 0 PDRD	sage3m3_lzd_yyyymmddd_hh_mm_vx.xx_cxx_type.pdrd
Definitive Orbit (Ephem) PDRD	sage3m3_epd_yyyymmddd_hh_mm_vx.xx_cxx_type.pdrd

c. Production Acceptance Notification

Level 0 PAN	sage3m3_lzd_yyyymmddd_hh_mm_vx.xx_cxx_type.pan
Definitive Orbit (Ephem) PAN	sage3m3_epd_yyyymmddd_hh_mm_vx.xx_cxx_type.pan

4.2.3 Product Delivery Record (PDR)

The purpose of the PDR is to announce the availability of data for transfer, including file names, location, and how long the data will be available in that location. The PDR file is generated and placed in the predefined directory by the SAGE III MOC host or server. ECS polls the SAGE III server, detects/acquires/validates the PDR, and schedules to pull the data. The ECS Data types and file types are depicted in Table 4-1.

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The required PDR PVL parameters are depicted in Table 4-2. The PDR PVL statements are ASCII strings, having at most 256 characters, in the form: "Parameter = Value." The Value strings shown in Table 4-2 include pre-defined values shown by single quote marks and processor determined values. Processor determined values include ASCII strings, ISO times, and integers to be filled in with appropriate values by a SAGE III MOC processor during PDR creation. A PDR PVL example is provided in Figure 4-3. The maximum allowed message length for a PDR is 1 megabyte. PDRs are validated by ECS to check that all required fields contain valid values and that the format of the PDR is correct and consistent with the standards. PDRs that adhere to the defined message standards shown in 4-5 are accepted and processed.

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Additional information on PVL can be found in the following documents:

- Consultative Committee for Space Data Systems (CCSDS), Parameter Value Language Specification (CCSD0006), Blue Book

Table 4-1. ECS Data Types and File Types

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ECS Data Type	File Type	File Description
g3aexp	SCIENCE	Level 0 data
	METADATA	Level 0 metadata
g3aeph	ORBIT	Definitive Orbit data
	METADATA	Definitive Orbit metadata
g3aexph	ANCILLARY	Level 0 Ancillary data/metadata
g3aephh	ANCILLARY	Definitive Orbit Ancillary data/metadata

CH02

Note 1. Each data type contains only one file of the specified file type.

CH02

Table 4-2. PDR PVL Parameters

Parameter	Description	Type	Format/ Max Size (Bytes)	Values
ORIGINATING_SYSTEM	Originator of Delivery Record	Variable String	ASCII (20)	SAGE III MOC Identifier (Note 1)
TOTAL_FILE_COUNT	Total number of files to transfer	Integer	ASCII (4)	1 - 9999
EXPIRATION_TIME (Note 2)	ISO Time for data deletion from originating system. This time is set by SAGE III MOC system based on available resources.	Fixed String	ASCII (20)	GMT in for the format: yyyy-mm-ddThh:mm:ssZ, where T indicates the start of time information and Z indicates "Zulu" time. (operations tunable amount of time after PDR sent)
OBJECT	Start of file group parameters (repeat for each group of files).	Fixed String	ASCII (10)	'FILE_GROUP'
DATA_TYPE	ECS Data Type	Fixed String	ASCII (8)	e.g., 'g3aexp'
NODE_NAME	Name of network node on which the file resides	Variable String	ASCII (64)	e.g., 'server.larc.nasa.gov'
OBJECT	Start of file parameters (repeat for each file in file group)	Fixed String	ASCII (9)	'FILE_SPEC'
DIRECTORY_ID	File directory name (i.e. path name)	Variable String	ASCII (Note 3)	e.g., /sageiii/group1/
FILE_ID	File name	Variable String	ASCII (Note 4)	SAGE III MOC file name (per SAGE III MOC Data/Metadata File Definition)
FILE_TYPE	Keyword to identify particular files within a data granule	Variable String	ASCII (20)	e.g., 'SCIENCE', 'ANCILLARY', 'METADATA', 'ORBIT'
FILE_SIZE	Length of file in bytes	Unsigned 32-bit Integer	ASCII (10)	< 2 GB
END_OBJECT	End of file parameters (repeat for each file)	Fixed String	ASCII (9)	'FILE_SPEC'
END_OBJECT	End of file group (repeat for each group of files)	Fixed String	ASCII (10)	'FILE_GROUP'

Note 1. Used in PAN & PDRD to identify SAGE III MOC System response.

Note 2. Only used when PDR server is not under ECS control.

Note 3. Size can vary up to 256 bytes total when DIRECTORY_ID is combined with FILE_ID.

Note 4. Size can vary up to 256 bytes total when FILE_ID is combined with DIRECTORY_ID.

CH02

```
ORIGINATING_SYSTEM = LaRC_SAGE_III_MOC;
```

```
TOTAL_FILE_COUNT = 4;
```

EXAMPLE

```
OBJECT = FILE_GROUP;
```

```
    DATA_TYPE =g3aexp;
```

```
    NODE_NAME = 17xsagesvr1.larc.nasa.gov;
```

```
    OBJECT = FILE_SPEC;
```

```
        DIRECTORY_ID = /level 0/sage;
```

```
        FILE_ID = sage3m3_lzm_19990924_v01.01_c01_prod;
```

```
        FILE_TYPE = METADATA;
```

```
        FILE_SIZE = 1240000;
```

```
    END_OBJECT=FILE_SPEC;
```

```
    OBJECT = FILE_SPEC;
```

```
        DIRECTORY_ID = /level 0/sage;
```

```
        FILE_ID = sage3m3_lzc_19990924_v01.01_c01_prod;
```

```
        FILE_TYPE =SCIENCE;
```

```
        FILE_SIZE =10000 ;
```

```
    END_OBJECT=FILE_SPEC;
```

```
END_OBJECT=FILE_GROUP;
```

```
OBJECT = FILE_GROUP;
```

```
    DATA_TYPE =g3aexph;
```

```
    NODE_NAME = 17xsagesvr1.larc.nasa.gov;
```

```
    OBJECT = FILE_SPEC;
```

```
        DIRECTORY_ID = /level 0/sage;
```

```
        FILE_ID = sage3m3_lza_19990924_v01.01_c01_prod;
```

```
        FILE_TYPE =ANCILLARY;
```

```
        FILE_SIZE =01500;
```

```
    END_OBJECT=FILE_SPEC;
```

```
END_OBJECT=FILE_GROUP;
```

EXAMPLE

CH02

Figure 4-3. Example PDR PVL

CH02

4.2.4 Product Delivery Record Discrepancy Message (PDRD)

The PDRD message is sent by the ECS in PVL to the SAGE III MOC, via FTP, only in the event that the PDR cannot be successfully validated. There are two types of PDRD messages; a short PDRD message and a long PDRD message. The short PDRD message is sent when an error is detected in the PDR that applies to each file group. The long PDRD message is sent when a parameter error within one or more file groups in the PDR is detected. Tables 4-3 and 4-4 define the PDRD messages.

Table 4-3. Short Product Delivery Record Discrepancy PVL Parameters

Parameter ²	Description	Type/Format (Length in Bytes)	Value ²
MESSAGE_TYPE	Short Product Delivery Record Discrepancy	Fixed String/ASCII (9)	SHORTPDRD
DISPOSITION	Disposition of Ingest Request ¹	Variable String/ASCII (64)	One of the following: "INVALID FILE COUNT" "ECS INTERNAL ERROR" "DATABASE FAILURES" "INVALID PVL STATEMENT" "MISSING OR INVALID ORIGINATING_SYSTEM PARAMETER" "DATA PROVIDER REQUEST THRESHOLD EXCEEDED" "DATA PROVIDER VOLUME THRESHOLD EXCEEDED" "SYSTEM REQUEST THRESHOLD EXCEEDED" "SYSTEM VOLUME THRESHOLD EXCEEDED"

Note 1. In any given instance, only one disposition value is provided. In cases where multiple errors may exist, the disposition value corresponding to the first error encountered will be provided.

Note 2. Each parameter/value is followed by an EOL mark.

Table 4-4. Long Product Delivery Record Discrepancy PVL Parameters

Parameter ²	Description	Type/Format (Length in Bytes)	Value ²
MESSAGE_TYPE	Long Product Delivery Record Discrepancy	Fixed String/ASCII (8)	LONGPDRD
NO_FILE_GRPs (to follow)	Number of File Groups in the PDR	Integer/ASCII (4)	Number of File Groups in the PDR

For each file group in the PDR

DATA_TYPE	ECS Data Type	ASCII String (20)	DATA_TYPE in PDR
DISPOSITION	Disposition of Ingest Request ¹	Variable String/ASCII (64)	One of the following: "SUCCESSFUL" "INVALID DATA TYPE" * "INVALID DIRECTORY" * "INVALID FILE SIZE" "INVALID FILE ID" * "INVALID NODE NAME" * "INVALID FILE TYPE" *

Note 1. For each file group, only one disposition value may be provided. In cases where multiple errors may exist, the disposition value corresponding to the first error encountered will be provided.

Note 2. Each parameter/value statement is followed by an EOL mark.

* Null string check only

4.2.5 Production Acceptance Notification Message

After the data have been ingested/archived by ECS, ECS automatically sends a Product Acceptance Notification (PAN) message in PVL via FTP to the SAGE III MOC. The PAN FTP announces the completion of data transfer and archival, and identifies any errors or problems that have been encountered. There are two types of the PAN messages: a short PAN message and a long PAN message. The short PAN message is sent to acknowledge a successful data transfer or indicates an error that affects all files defined in the PDR. A long PAN message is sent to provides disposition(s) on a specific file group(s) defined in the PDR. Tables 4-5 and 4-6 define the PAN messages.

CH02

CH02

Table 4-5. Short Production Acceptance Notification PVL Parameters

CH02

Parameter ²	Description	Type/Format (Length in Bytes)	Value ²
MESSAGE_TYPE	Short Production Acceptance Notification Definition	Fixed String/ASCII (8)	SHORTPAN
DISPOSITION	Disposition of Ingest Request ¹	Variable String/ASCII (64)	One of the following: "SUCCESSFUL" "NETWORK FAILURE" "UNABLE TO ESTABLISH FTP/KFTP CONNECTION" "ALL FILE GROUPS/FILES NOT FOUND" "FTP/KFTP FAILURE" "POST-TRANSFER FILE SIZE CHECK FAILURE" "FTP/KFTP COMMAND FAILURE" "DUPLICATE FILE NAME IN GRANULE" "METADATA PREPROCESSING ERROR" "RESOURCE ALLOCATION FAILURE" "ECS INTERNAL ERROR" "DATA BASE ACCESS ERROR" "INCORRECT NUMBER OF METADATA FILES" "INCORRECT NUMBER OF SCIENCE FILES" "INCORRECT NUMBER OF FILES" "DATA CONVERSION FAILURE" "REQUEST CANCELLED" "UNKNOWN DATA TYPE" "INVALID OR MISSING FILE TYPE" "FILE I/O ERROR" "DATA ARCHIVE ERROR"
TIME_STAMP	ISO Time when Destination System transferred the last part of data	ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ, where T indicates the start of time information and Z indicates "Zulu" time (Null if disposition is not "SUCCESSFUL")

CH02

Note 1. In any given instance, only one disposition value may be provided. In cases where multiple errors have occurred, the disposition value corresponding to the first error encountered will be provided.

Note 2. Each parameter/value statement is followed by an EOL mark.

CH02

Table 4-6. Long Production Acceptance Notification PVL Parameters

CH02

Parameter ²	Description	Type/Format (Length in Bytes)	Value ²
MESSAGE_TYPE	Long Production Acceptance Notification	Fixed String/ASCII (7)	LONGPAN
NO_OF_FILES	Number of Files in PDR	ASCII (4)	TOTAL_FILE_COUNT parameter in PDR

CH02

For each File in the PDR

FILE_DIRECTORY	ASCII string specifying file directory location	ASCII (<256) Equivalent to PDR length	DIRECTORY_ID parameter in PDR
FILE_NAME	File names on system creating PDR	ASCII (<256) Equivalent to PDR length	FILE_ID parameter in PDR
DISPOSITION	Disposition of Ingest Request ¹	Variable String/ASCII (64)	One of the following: "SUCCESSFUL" "NETWORK FAILURE" "UNABLE TO ESTABLISH FTP/KFTP CONNECTION" "ALL FILE GROUPS/FILES NOT FOUND" "FTP/KFTP FAILURE" "POST-TRANSFER FILE SIZE CHECK FAILURE" "FTP/KFTP COMMAND FAILURE" "DUPLICATE FILE NAME IN GRANULE" "METADATA PREPROCESSING ERROR" "RESOURCE ALLOCATION FAILURE" "ECS INTERNAL ERROR" "DATA BASE ACCESS ERROR" "INCORRECT NUMBER OF METADATA FILES" "INCORRECT NUMBER OF SCIENCE FILES" "INCORRECT NUMBER OF FILES" "DATA CONVERSION FAILURE" "REQUEST CANCELLED" "UNKNOWN DATA TYPE" "INVALID OR MISSING FILE TYPE" "FILE I/O ERROR" "DATA ARCHIVE ERROR"
TIME_STAMP	ISO Time when Destination System transferred the last part of the data	ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ, where T indicates the start of time information and Z indicates "Zulu" time. (Null if disposition is not "SUCCESSFUL")

CH02

Note 1. In any given instance, only one disposition value may be provided. In cases where multiple errors have occurred, the disposition value corresponding to the first error encountered will be provided.

Note 2. Each parameter/value statement is followed by an EOL mark.

4.2.6 Error Conditions

During the course of data exchange via FTP, the following error conditions may arise:

- Failure to establish TCP/IP connection
- Erroneous FTP command
- File Not Found (listed in PDR, but not found on disk)
- File Not Readable due to Permissions

4.2.7 Error Handling/Backup Methods

Should a problem develop during an FTP file transfer due to any of the above error conditions, an operator-tunable number of attempts are made to pull the data. In the event that problems cannot be resolved within this operator-tunable number of attempts, ECS and the SAGE III MOC operations personnel have the option to coordinate data delivery on approved high density storage media. While the use of tape media as a backup is not a requirement, it may be useful during emergencies, and is supported by ECS.

In the event that tape media is used during emergencies, a separate Physical Media Delivery Record (PMPDR) file must be supplied for each piece of media delivered to ECS. The PMPDR must be contained as a file on the media and be available separately as hard copy---in the event that a file check on the media by ECS reveals that the PMPDR is missing, SAGE III MOC operations personnel will supply the LaRC DAAC - ECS operations personnel with a hardcopy PMPDR. The format and information content for the PMPDR is the same as that for the Product Delivery Record defined in Tables 4-6 (excluding EXPIRATION_TIME).

|CH02

4.2.8 Physical Media

A variety of approved high density storage media will be available for providing backup during data transfer including the following:

- a. 8 mm tape [112 meters; 5GB standard capacity]
- b. 4 mm digital audio tape (DAT) [90 meters; 2GB standard capacity]

Data are distributed uncompressed. The blocking factor is 127. The TAR tape format is supported. Paper labels for each tape identify the names of files contained on the tape, and the order in which these files have been written.

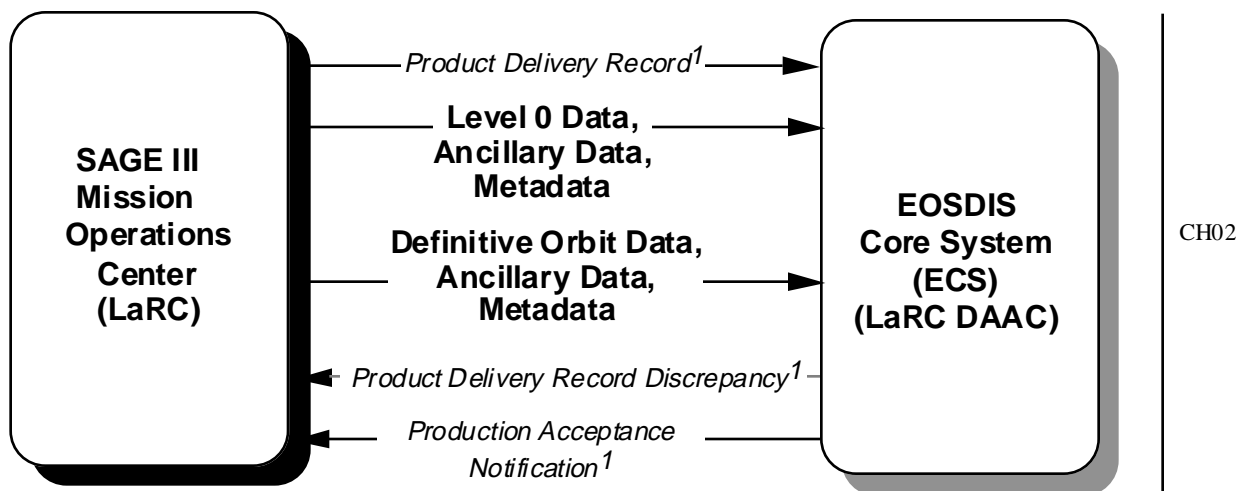
4.3 Data Exchange Security

Security between the ECS and the SAGE III MOC is provided via basic password authentication/authorization method during login to perform standard "FTP" services. The ECS establishes an account with the SAGE III MOC to enable ECS to "get" data via "FTP" from a SAGE III designated server as well as send (push) FTP messages to the SAGE III server.

5. Data Flow Descriptions

Figure 5-1 identifies the data flows between ECS at the LaRC DAAC and SAGE III MOC. These flows are accomplished via FTP. Descriptions of the data exchange framework supporting these flows are found in Section 4 of this ICD. Specific characteristics of each direct data flow shown in Figure 5-1 are described in Sections 5.1 and 5.2, including data transfer characteristics, format and content .

CH02



Note 1: Defined in Section 4

Figure 5-1. SAGE III MOC - ECS Data Transfer

5.1 SAGE III Data Transfer Profile

Nominally the SAGE III MOC provides ECS two PDRs once a day. Definitive orbit data follows its associated Level 0 data by one day. One PDR defines the Level 0 data, Level 0 metadata/construction record and the Level 0 ancillary data files which are contained within four separate files. The second PDR defines the definitive orbit data, definitive orbit metadata and the definitive orbit ancillary files which are three separate files. The ancillary metadata is included as a header within the ancillary data file.

CH02

5.2 SAGE III Metadata

Within ECS, the term “metadata” relates to all information of a descriptive nature which is associated with the product or dataset. This information has been analyzed and developed into a core metadata model. Product specific metadata is additional information added for the unique characteristics which can be product, collection or site specific. These are described as non-core or product specific attributes.

Within the ECS document (DID) 311-CD-008-004 Science Data Processing Segment (SDPS) Database Design and Database Schema Specifications for the ECS Project detailed information is provided on the types of metadata and the categories of the metadata. The SAGE III MOC provides the ECS with collection level and granule level metadata for each product, i.e., Level 0 and definitive orbit data. | CH02

Level 0 granule metadata and definitive orbit granule metadata are provided by the SAGE III MOC to the ECS in the form of Object Description Language (ODL) statements. ODL accesses data which is kept in a hierarchical format using GROUP, OBJECT and PARAMETER hierarchy. An ODL statement is represented as “Parameter = Keyword”. ODL only recognizes a character string value when it is in quotation marks. Comments in ODL are enclosed in delimiters as follows: /*...comment...*/. A detailed description of ODL can be found in the Planetary Data System Standards Reference and the University of Colorado Laboratory for Atmospheric and Space Physics: User’s Guide for the Object Description Language (ODL) Processing Software Library, as listed in Section 2 of this document.

5.2.1 SAGE III Collection Level Metadata

Collection level metadata for the Level 0 data and definitive orbit data is categorized in the “intermediate” class of the ECS core metadata model. Document 311 defines the mandatory attributes for this class of data. The collection data is considered to be nominally static with only an occasional update. The mechanism to provide this interface between the SAGE III MOC and ECS is via a form located on a predesignated World Wide Web Site. | CH02

5.2.2 SAGE III Granule Level Metadata

The SAGE III MOC provides ECS the granule level metadata comprised of Level 0 metadata, Level 0 construction record (additional Level 0 metadata) and definitive orbit metadata. The three files provided daily are approximately a total of 3 MB in volume. | CH02

5.2.2.1 Level 0 Granule Metadata

The Level 0 granule metadata attributes - Mandatory and Product Specific are defined in Table 5-1. The maximum size of fields are defined within the DID 311 specification. The file naming convention for the Level 0 metadata file is as follows: | CH02

⇒ Level 0 Metadata File Name: sage3m3_lzm_yyyymmdd_vx.xx_cxx_type

Where:

lzm identifies product = Level 0 metadata
 yyyy identifies the year
 mm identifies the month of the year
 dd identifies the day of the month
 vx.xx identifies the version number
 cxx identifies the cycle number
 type identifies the type of product (“test” for the test version or “prod” for production version)

CH02

Table 5-1. SAGE III Level 0 Granule Metadata (Mandatory and Product Specific) Definition (1 of 2)

Item No.	ECS Attribute	SAGE Provided Parameter	Description	Type	Value
1	ShortName	Shortname	The short Filename of the Data File	String	g3aexp
2	RangeBeginningTime RangeBeginningDate	Data_Start_Time	The Year, Day, Time of the first packet in that data set Time First Event	CCSDS UTC Format A	Epoch Time
3	RangeEndingTime RangeEndingDate	Data_end_time	The Year, Day, Time of the last packet in that data set - Time Last Event	CCSDS UTC Format A	Epoch time
4	SpatialDomainContainer	SpatialDomainContainer		N/A	N/A

CH02

SAGE III Product Specific Metadata

5	AdditionalAttributeName	Overflow_flag	When the event goes into the next day	String	Example: Overflow_flag
	ParameterValue		Actual number of value	String	YES or NO
6	Additional AttributeName	TotalEventsNE	The Number of Events for that Day	String	Example: TotalEventsNE
	ParameterValue	Total_NE	Actual number of value	Integer	Example: 24
7	Additional AttributeName	TotalEventsSS	The Number of SS Events for that Day	String	Example: TotalEventsSS
	ParameterValue	Total_SS	Actual number of value	Integer	Example: 15
8	Additional AttributeName	TotalEventsSR	The Number of Sr Events for that Day	String	Example: TotalEventsSR
	ParameterValue	Total_SR	Actual number of value	Integer	For Example: 15
9	Additional AttributeName	TotalEventsMR	The Number of MR Events for that Day	String	Example: TotalEventsMR
	ParameterValue	Total_MR	Actual number of value	Integer	Example: 5

CH02

CH02

CH02

CH02

CH02

**Table 5-1. SAGE III Level 0 Granule Metadata (Mandatory and Product Specific)
Definition (2 of 2)**

Item No.	ECS Attribute	SAGE Provided Parameter	Description	Type	Value	
10	Additional AttributeName	TotalEventsMS	The Number of MS Events for that Day	String	Example: TotalEventsMS	
	ParameterValue	Total_MS	Actual number of value	Integer	Example: 6	CH02
11	Additional AttributeName	TotalEventsSpecial Calibration Tests	The Number of Special Calibration Tests	String	Example: TotalEventsSpecial Calibration Tests	
	ParameterValue	Special_Calibration	Actual number of value	Integer	Example: 1	CH02
12	Additional AttributeName	TotalResearchModeTests	The Number Research Mode Tests	String	Example: TotalResearchModeTests	
	ParameterValue	Research_mode	Actual number of value	Integer	Example: 1	CH02
13	Additional AttributeName	Begin_Orbit_Number	The number of the first orbit for that day	String	Example: Begin_Orbit_Number	
	ParameterValue	Begin_Orbit_Orbit	Actual number of value	Integer	Example: XXXXXX00 (SR Orbit)	CH02
14	Additional AttributeName	Ending_Orbit_Number	The number of the last orbit for that day	String	Example: Ending_Orbit_Number	
	ParameterValue	Ending_Orbit_Number	Actual number of value	Integer	For Example: XXXXXX02 (SS Orbit)	CH02

5.2.2.2 Level 0 Construction Record

The SAGE III construction record format is a binary format which is modeled after the EDOS construction record format found in ICD 510-ICD-EDOS/EGS (Section 8.1.2.7). This information is considered additional ECS granule level metadata. The file naming convention for the Level 0 construction record file is as follows:

⇒ Level 0 Construction Record File Name: sage3m3_lzc_yyyymmdd_vx.xx_cxx_type

Where:

lzc	identifies the product = Level 0 construction
yyyy	identifies the year
mm	identifies the month of the year
dd	identifies the day of the month
vx.xx	identifies the version number
cxx	identifies the cycle number
type	identifies the type of product (“test” for the test version or “prod” for production version)

Table 5-2 provides the level 0 construction record format and contents.

Table 5-2. SAGE III Level 0 Data Construction Record Definition (1 of 4)

Item No.	Attribute	Type//Size	Data Characteristics
1	SAGE III Software Version Number	Unsigned Integer/ 2 Bytes	Not Used
2	Construction Record Type	Unsigned Integer/ 1 Byte	1-PDS (Production Data Set) 4-TDS (Test Data Set)
3	Fill/Spare	Unsigned Integer/ 1 Byte	
4	PDS/EDS Identification	ASCII and Unsigned Integer/ 36 Bytes	Not Used
5	Fill/Spare	Unsigned Integer/ 7 Bits	
6	Test Flag	Logical Flag / 1 Bit	Value 0= Operational Data 1= Test Data
7-1	Fill/Spare	Unsigned Integer/ 1 Byte	
7-2	Fill/Spare	Unsigned Integer/ 8 Bytes	
8	Number of Scheduled Spacecraft contact start/stop times	Unsigned Integer/ 2 bytes	Not Used
8-1	Fill/Spare		
8-2	For a particular Spacecraft contact start/stop pair start time	NASA PB-5 Code format /7 Bytes/	Not Used
8-3	Fill/Spare		
8-4	For a particular Spacecraft contact start/stop pair Stop Time	NASA PB-5 Code Format /7 Bytes	Not Used
8-5	For the next Spacecraft start and stop pair, repeat the above items (8-1 to 8- 4) if applicable		Not Used
9	Number of bytes of WFF generated Fill data	Unsigned Integer/ 8 Bytes	Not Used
10	Count of packets that had discrepancies between packet header length item and the actual packet length.	Unsigned Integer /4 Bytes	Will use number of CRC errors
11	CCSDS binary timecode (CCSDS Day segmented Time Code /Spacecraft Time Format) from the source packet of the first packet received	Integer Formatted /8 Bytes	0:0:0
12	CCSDS binary timecode (CCSDS Day segmented Time Code /Spacecraft Time Format) from the source packet of the last packet received	Integer Formatted/ 8 Bytes	23:59:59
13	Fill/Spare		
14	Date and Time annotation when the first packet was received at WFF	NASA PB-5 Code Format/ 7 Bytes	Not Used

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Table 5-2. SAGE III Level 0 Data Construction Record Definition (2 of 4)

Item No.	Attribute	Type//Size	Data Characteristics	
15	Fill/Spare			
16	Time and date annotation when the last packet in the whole dataset was received at WFF	NASA PB-5 Code Format/7 Bytes	Not Used	CH02
17	For the dataset ,count of packets from VCDUs with errors corrected by R-S decoding	Unsigned Integer/ 4 Bytes	Not Used	
18	Number of CCSDS packets in the whole data set	Unsigned Integer/	Can be derived from Processing.	
19	Number of bytes in the whole data set	Unsigned Integer/ 8 Bytes	Total number of Octets for all the CCSDS packets in the data set. (Can be derived from processing)	
20	Number of packets with Source Sequence Counter (SSC) discontinuities	Unsigned Integer/ 4 Bytes	Number of gaps in the data set. (Can be derived looking at the Source Packet Primary Header)	
21	Fill/Spare			
22	For this data set, the time of completion when the whole data set was finished building	NASA PB-5 Code Format/ 7 bytes	This will be the time the data set and the construction record were completed. Epoch Time Recommend using WFF Epoch time for consistency (Oct 10,1995)	CH02
23	Fill/Spare			
24	The number of APIDs in the Dataset	Unsigned Integer/ 1 Byte	Number of APIDS = 1	
24-1	Fill/Spare			
24-2	APID (SCID and APID in the Data set)	Unsigned Integer/ 3 Bytes	APID is = 001	
24-3	For this APID, index to the first packet in the data set	Unsigned Integer /8 Bytes	Since SAGE III has only one APID, this will refer to the first packet in the whole data set.	
24-4	Fill/Spare			
24-5	For this APID, identify the number of VCIDs in the data set	Unsigned Integer /1 Byte	N/A	CH02
24-5.1	Fill/Spare			
24-5.2	VCDU-ID	Unsigned Integer/ 2 Bytes	29	CH02
24-5.3	For the next VCID, repeat the above items (24-5.1 through 24-5.2)		Not Used	
24-6	For this APID identify the number of packets with SSC discontinuities (the number of gaps)	Unsigned Integer/ 4 Bytes	Not Used	
24-6.1	For this particular APID identify the first missing packet SSC in the gap.	Unsigned Integer /4 Bytes	SSC number of the packet before the gap	
24-6.2	For this APID gap, pointer to the packet, with the same APID, that is immediately after the SSC gap in the data set.	Unsigned Integer/ 8 Bytes	SSC number of the packet after the gap	
24-6.3	For this APID gap, the number of packet SSC missed within the gap.	Unsigned Integer /4 Bytes	Derived by subtracting the SSC counter number Item 24-6.1 from 24-6.2	CH02

Table 5-2. SAGE III Level 0 Data Construction Record Definition (3 of 4)

Item No.	Attribute	Type//Size	Data Characteristics
24-6.4	For this APID gap, the spacecraft time stamp that is immediately before the SSC gap in the data set.	Integer Formatted /8 Bytes	Time Stamp of the packet before the gap.
24-6.5	For this APID gap, the spacecraft time stamp that is immediately after the SSC gap in the data set.	Integer Formatted/ 8 Bytes	Time Stamp of the packet after the gap.
24-6.6	Fill/Spare		
24-6.7	For this APID gap, date and time annotation of the packet, with the same APID, that is immediately before the SSC gap in the data set.	NASA PB-5 Code Format /7 Bytes	Ground time of the packet received before the gap. This can be found from the WFF QC Header.
24-6.8	Fill/Spare		
24-6.9	For this APID gap, date and time annotation of the packet, with the same APID, that is immediately after the SSC gap in the data set.	NASA PB-5 Code Format/7 Bytes	Ground time of the packet received after the gap. This can be found in the WFF QC Header.
24-6.10	For the next missing packet SSC (gap) repeat the above items 24-6.1 through 24-6.9		Repeat
24-7	For this APID, number of entries in list of packets containing WFF generated fill data	Unsigned Integer /4 Bytes	Not Used
24-7.1	For this APID, SSC of packet containing WFF generated fill data (SSC from CCSDS packet)	Unsigned Integer 4 bytes	Not Used
24-7.2	For this APID, index (byte offset) into the dataset to the fill packet	Unsigned Integer/ 8 Bytes	Not Used
24-7.3	For this APID, index to the fill octet for the above packet	Unsigned Integer /4 Bytes	Not Used
24-7.4	For the next fill packet identification repeat the above items (24-7.1 through 24-7.3)		Not Used
24-8	For this APID count of octets of WFF generated fill data	Unsigned Integer/ 8 Bytes	Not Used
24-9	For this APID, the number of packets that had discrepancies between packet header length and the actual packet	Unsigned Integer/ 4 Bytes	Will use number of CRC errors
24-10	For this APID, CCSDS binary time code from the secondary header of the first packet in the data set.	Integer formatted /8 Bytes	SAGE III receives time in every packet. So this will refer to the time of the first packet in the whole data set.
24-11	For this APID, CCSDS binary time code from the secondary header of the last packet in the data set.	Integer formatted /8 Bytes	SAGE III receives time in every packet. So this will refer to the time of the last packet in the whole data set.
24-12	Fill/Spare		
24-13	For this APID the ground time annotation when the first packet was received	NASA PB-5 Code Format /7 Bytes	Not Used
24-14	Fill/Spare		

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Table 5-2. SAGE III Level 0 Data Construction Record Definition (4 of 4)

Item No.	Attribute	Type/Size	Data Characteristics
24-15	For this APID the ground time annotation when the last packet was received	NASA PB-5 Code Format/ 7 Bytes	Not Used
24-16	For this APID, count of packets from VCDUs with errors corrected by R-S decoding.	Unsigned Integer /4 Bytes	Not Used
24-17	For this APID, count of packets in the data set.	Unsigned Integer/ 4 Bytes	Not Used
24-18	For this APID, size in Octets	Unsigned Integer /8 Bytes	Not Used
24-19	For this APID, fill/spare		Not Used
24-20	For the next APIDs repeat the above items (24-1 through 24-19)		Not Used
25	Fill/Spare		
25-1	For the whole data set, number of files that the data sets resides on	Unsigned Integer/ 1 Byte	1
25-2	File name for the Data set	ASCII 3/6 Bytes	sage3m3_lzd_yyyymmdd_vxx.x_cx.x_type where (TYPE is PROD for Production or TYPE is TEST for Test Data)
25-3	Fill/Spare		
25-4	For this file or data set number of APIDs	Unsigned Integer /1 Byte	1
25-4.1	Fill/Spare		
25-4.2	APID in the Data Set	Unsigned Integer /3 Bytes	Not Used
25-4.3	For this APID, CCSDS binary timecode of first packet with this APID in the data set	Integer formatted/ 8 Bytes	Not Used
25-4.4	For this APID, CCSDS binary timecode of last packet with this APID in the data set	Integer formatted/ 8 Bytes	Not Used
25-4.5	Fill/Spare		
25-4.6	For the next APID repeat the above items (25-5.1 through 25-5.5)		Not Used
25-5	For this data set, for the next file name repeat the above items (25-2 through 25-4.6)		Not Used

Note 1: All attribute data provided with time values should be toolkit compliant.

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5.2.2.3 Definitive Orbit Metadata

Table 5-3 defines the content and format for the SAGE III definitive orbit metadata. The maximum size of fields are defined within the DID 311 specification. The file naming convention for the definitive orbit metadata file is as follows:

⇒ Definitive Orbit Metadata File Name: sage3m3_epm_yyyymmdd_vx.xx_cxx_type

Where:

epm	identifies the product = ephemeris metadata
yyyy	identifies the year
mm	identifies the month of the year
dd	identifies the day of the month
vx.xx	identifies the version number
cxx	identifies the cycle number
type	identifies the type of product (“test” for the test version or “prod” for production version)

Table 5-3 defines the content and format for the SAGE III definitive orbit metadata. The maximum size of parameter/value is defined within the DID 311 specification.

Table 5-3. SAGE III Definitive Orbit Metadata Definition

Item No.	Attribute Name	Description	Type	Value	
1	Shortname	The short filename	String	g3aeph	CH02
2	SizeMBECSDDataGranule	Size of the metadata	Integer	1	
3	SpatialDomainContainer		N/A	N/A	
4	spacecraftID	Spacecraft Name	Integer	29	CH02
5	ASCIITimeRange	Start stop times to nearest hour or better	String	Example: 1999-04-11T06Z to 1999-04-12T06Z	
6	Source	Source of the Data	String	SAGEIIIMOC	
7	Version	Version Number	String	Example:1	
8	ParentFile	Actual Filename of parent file	String	Example: sage3m3_epd_yyyymmdd_vx.xx_cx.x_type Type will be “prod, or test ”	CH02
9	Data_Start_time	Ephemeris data set start time	Double Precision	Seconds since Jan 1, 1993	
10	Data_End_time	Ephemeris data set end time	Double Precision	Seconds since Jan 1, 1993	CH02

5.3 SAGE III Level 0 Data

The SAGE III Level 0 consists of 107 sixteen-bit word source packets of CCSDS-formatted instrument data. Data packets captured during a Greenwich day are quality-checked and gap-annotated prior to delivery to the ECS. The daily Level 0 data delivery consists of instrument data in both science, research, and engineering operating modes in a binary format. The volume of Level 0 data provided to ECS on a daily basis is approximately 123 MB.

One-hundred and seven word SAGE III instrument telemetry packets are formatted using the CCSDS transfer frame and source packet constructs specified in CCSDS Blue Book 102.0-B-3, Packet Telemetry. Each telemetry packet consists of an three word CCSDS header, followed by one hundred three (103) instrument words of instrument data, with a one word Frame Error

Control Field appended to the end of each packet. A single application identification field is used for all SAGE III data (source is Data Storage Unit on-board Meteor-3M spacecraft). Instrument operating modes are contained in status words within the SAGE III telemetry packet. Technical details of the SAGE III data packet can be found in Meteor-3M / SAGE III Level 0 / Definitive Orbit Data Format Description, LaRC 475-01-021.

The file naming convention for the Level 0 file is as follows:

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⇒ Level 0 Data File Name: sage3m3_lzd_yyyymmdd_vx.xx_cxx_type

Where:

lzd	identifies the product = Level 0 data
yyyy	identifies the year
mm	identifies the month of the year
dd	identifies the day of the month
vx.xx	identifies the version number
cxx	identifies the cycle number
type	identifies the type of product (“test” for the test version or “prod” for production version)

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5.4 SAGE III Definitive Orbit Data

SAGE III definitive orbit data is obtained by processing GPS/GLONASS spacecraft position measurements. The position measurements, taken once-per-orbit, are combined and processed at the SAGE III MOC using orbit determination software provided by the Goddard Space Flight Center’s Flight Dynamics Facility. A definitive orbit data record consists of time, orbit number, spacecraft position (X, Y, Z), and spacecraft velocity (XDOT, YDOT, ZDOT). Definitive orbit records are written to a twenty-four hour definitive orbit data file for periods when an occultation measurement is being made. Definitive orbit data records are written at a 64 hertz rate during solar measurements and at a 16 hertz rate during lunar measurements. The volume of definitive orbit data provided to ECS on a daily basis is approximately 4 MB.

The definitive orbit event data will be written to a binary file as defined in Table 5-4. The coordinate system will be True of Date (TOD) ECI.

The file naming convention for the definitive orbit file is as follows:

⇒ Definitive Orbit Data File Name: sage3m3_epd_yyyymmdd_vx.xx_cxx_type

Where:

epd	identifies product = ephemeris data
yyyy	identifies the year
mm	identifies the month of the year
dd	identifies the day of the month
vx.xx	identifies the version number
cxx	identifies the cycle number
type	identifies the type of product (“test” for the test version or “prod” for production version)

Table 5-4. SAGE III Definitive Orbit Data Definition

Item No.	Name	Type	Description
1	Orbit Number	Integer	Orbit number from beginning of mission.
2	Time	Character (25)	CCSDS ASCII Time Code A example: 1988-01-18T17:20:43.123Z('\0')
3	X	Double Precision	X position component of position vector, km
4	Y	Double Precision	Y position component of position vector, km
5	Z	Double Precision	Z position component of position vector, km
6	XDOT	Double Precision	X component of velocity vector, km / second
7	YDOT	Double Precision	Y component of velocity vector, km / second
8	ZDOT	Double Precision	Z component of velocity vector, km / second

Technical details of the SAGE III definitive orbit data format can be found in Meteor-3M / SAGE III Level 0 / Definitive Orbit Data Format Description, LaRC 475-01-021.

5.5 SAGE III Level 0 Ancillary Data/Metadata

Level 0 ancillary data provided to ECS is in ASCII format to aid in the processing of SAGE III Level 0 data to a higher level product. Level 0 metadata is provided to ECS in ODL format. The associated metadata is contained in the same files as the ancillary data. The volume of Level 0 ancillary data/metadata provided to ECS on a daily basis is approximately .15 MB. Table 5-5 defines the Level 0 ancillary metadata product.

The file naming convention for the Level 0 ancillary data file is as follows:

Level 0 Ancillary File Name: sage3m3_lza_yyyymmdd.vx.xx_cxx_type

Where:

lza	identifies product = Level 0 ancillary
yyyy	identifies the year
mm	identifies the month of the year
dd	identifies the day of the month
vx.xx	identifies the version number
cxx	identifies the cycle number
type	identifies the type of product (“test” for the test version or “prod” for production version)

Table 5-5. Level 0 Ancillary Metadata Definition

Item No.	Parameter	Description	Type	Value
1	Shortname	The short Filename	String	g3aexph
2	ParentFile	The Parent Data File name	String	sage3m3_lzd_yyyymmdd_vx.xx_cxx_type
3	Data_Start_Time	The Year, Day, Time of the first packet in that data set	CCSDS UTC Format A	EpochTime
4	Data_End_Time	The Year, Day, Time of the last packet in that data set	CCSDS UTC Format A	EpochTime

Table 5-5. Level O Ancillary Data/Metadata Definition (2 of 2)
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5.6 SAGE III Definitive Orbit Ancillary Data/Metadata

As part of the definitive orbit process, an ancillary data/metadata file is created with “bookkeeping” information that is used in later processing. The definitive Ephemeris ancillary data is ASCII data with a record describing processed definitive ephemeris for each event. The definitive Ephemeris metadata is in ODL format. The volume of definitive orbit ancillary data/metadata provided to ECS on a daily basis is approximately 0.15 MB. Table 5-6 defines the definitive orbit ancillary metadata.

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The file naming convention for the definitive orbit ancillary data/metadata file is as follows:

Definitive Orbit Ancillary File Name: sage3m3_epa_yyyymmdd.vx.xx_cxx_type

Where:

epa	identifies product = definitive orbit ancillary
yyyy	identifies the year
mm	identifies the month of the year
dd	identifies the day of the month
vx.xx	identifies the version number
cxx	identifies the cycle number
type	identifies the type of product (“test” for the test version or “prod” for production version)

Table 5-6. SAGE III Definitive Orbit Ancillary Metadata Definition

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Item No.	Parameter	Description	Type	Value
1	Shortname	The short Filename	String	g3aeph
2	ParentFile	The Parent Data File name	String	sage3m3_epd_yyyymmdd_vx.xx_cxx_type (Type will be “prod or test”)
3	Data_Start_Time	The Year, Day, Time of the first packet in that data set	CCSDS UTC Format A	EpochTime
4	Data_End_Time	The Year, Day, Time of the last packet in that data set	CCSDS UTC Format A	EpochTime

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Appendix A
Work-off Plan for the ECS the SAGE III MOC ICD
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Abbreviations and Acronyms

ARP	Address Resolution Protocol
ASCII	American Standard Code for Information Interchange
CCB	Configuration Control Board
CCR	Configuration Change Request
CCSDS	Consultative Committee for Space Data Systems
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CERES	Clouds and the Earth's Radiant Energy System
CPIO	Copy files In from and Out to an archive
CSMS	Communications and System Management Segment
DAAC	Distributed Active Archive Center
DAT	Digital Audio Tape
DCN	Document Change Notice
DP_CIO	Data Products Content Identifier Object
ECS	EOSDIS Core System
EDU	Exchange Data Unit
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
ESDIS	Earth Science Data and Information System
FDDI	Fiber Distributed Data Interface
FTP	File Transfer Protocol
GRIB	GRid In Binary
GSFC	Goddard Space Flight Center
HDF	Hierarchical Data Format
IATO	Integration and Acceptance Test Office
I&T	integration and test
ICD	Interface Control Document
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force

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IP	Internet Protocol
Ir1	interim release -1
IRD	Interface Requirements Document
KB	Kilobytes (10^3 bytes)
LAN	Local Area Network
LaRC	Langley Research Center
MB	Megabyte (10^6 bytes)
MOC	Mission Operations Center
MR	Moon Rise
MS	Moon Set
ODL	Object Description Language
OSI	Open Systems Interconnection
PAN	Production Acceptance Notification
PDR	Product Delivery Record
PDRD	Product Discrepancy Delivery Record
PMPDR	Physical Media Product Delivery Record
PVL	Parameter Value Language
RFC	Request For Comments
RIP	Routing Information Protocol
SAGE	Stratospheric Aerosol and Gas Experiment
SCF	Science Computing Facility
SMEX	Small Explorer
SR	Sun Rise
SS	Sun Set
TAR	Tape Archive
TBD	To Be Determined
TBR	To Be Resolved
TBS	To Be Supplied
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TRMM	Tropical Rainfall Measuring Mission
TOD	True of Date
WFF	Wallops Flight Facility

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